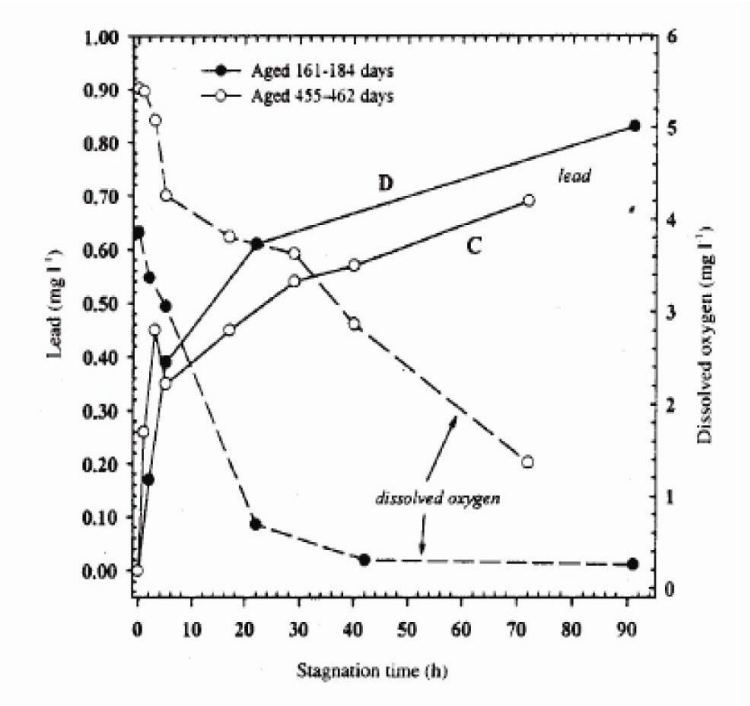
I am concerned that the safe harbor level for lead should explicitly consider the potential for **lead contamination of drinking water, including water used in food preparation.**

Lead contamination of drinking water

Lead in drinking water primarily results from corrosion from Pb pipes, Pb-based solder, or brass or bronze fixtures within a residence (EPA 2013). There are 3 principal factors determining how much Pb will leach into drinking water: how much lead is in the components of the public and especially private water distribution systems, how corrosive the water is and the length of time that drinking water remains stagnant in a pipe or fixture. For instance, an estimated 47% of total leached Pb was observed in the first 500 mL of water after overnight stagnation (Singh and Mavinic, 1991).

Lead levels at the tap can fluctuate easily by an order of magnitude, depending upon the faucet-specific microconditions and the household usage patterns. Furthermore, lead contamination of drinking water shows great between-house variability.



Impact of stagnation time on lead and dissolved oxygen concentration in lead pipe (13 mm diameter)
exposed to non-softened water in Study A.

Change in lead concentration versus stagnation time. (Reprinted from Lytle and Schock, 2000).

Lead exposure from drinking water

Lead in water, while generally low in the United States, has been linked to elevated blood-Pb concentrations. For instance, in a prospective study, children exposed to water with Pb concentrations greater than 5 ppb had blood-Pb levels ~1.0 µg/dL higher than children with water-Pb levels less than 5

ppb (Lanphear et al., 2002). Thus, water may be a significant source of Pb exposure even at the low levels typical in the US, especially for formula-fed infants, pregnant women, athletes, and laborers.

The 1991 EPA Lead and Copper Rule was designed to address these factors, but – as a review of newspaper reports about Washington DC in 2004, Durham NC in 2007 and Flint MI in 2015 indicate – local, state and federal oversight and enforcement have been inconsistent. Consistent monitoring of routine high-risk conditions, such as first flush sampling, is necessary to identify actual exposures.

Lead from drinking water contributes to dietary lead exposure

Using the Dietary Exposure Potential Model, Moschandreas et al. (2002) reported that drinking water, coffee and tea (likely reflecting Pb from the drinking water source) were major contributors to estimated daily dietary Pb intake. In addition, many foods, such as pasta and rice, are 60% tap water.

Further, many foodstuffs absorb lead during cooking. Little et. al. 1981 noted that some vegetables and rice removed and absorbed up to 80% of the lead in the water, and even bagged tea absorbed 30-40%. Thus, concentrations of lead in foods may exceed the levels in the water used for preparation and in the uncooked food.

In addition, fasting conditions have been shown to increase Pb absorption dramatically (Rabinowitz et al., 1980). Morning consumption is a 'fasting' condition.

Unfortunately, it is common that due to study design and other considerations, sampling protocols for drinking water are often poorly designed to capture lead contamination. The main consideration is resistance to using first flush water. First flush is often seen as an unusual exposure. But it occurs at every faucet in every home at least once a day – in the morning, and possibly more often if the occupants are out of the house all day, for instance working. Indeed, while high, first flush levels are ROUTINE exposures.

Inappropriate sampling of water to determine lead concentrations may explain some inconsistencies within or between studies. In reports from the NHEXAS, for instance, Pb concentrations measured in households throughout the Midwest were significantly higher in solid food compared to beverages and tap water (Clayton et al., 1999; Thomas et al., 1999). However, beverages appeared to be the dominant dietary pathway for Pb according to the statistical analysis (Clayton et al., 1999). The authors then speculated a potential greater bodily absorption of Pb from liquid sources (Thomas et al., 1999). Indeed since lead in solution is essentially all bioavailable in contrast to lead in food, this is quite plausible. Dietary intakes of Pb were greater than those calculated for intake from home tap water or inhalation on a µg/day basis (Thomas et al., 1999). Another explanation – better drinking water sampling and increased Pb absorption after 'fasting' – may account for some of the inconsistencies.

In summary, water lead, because it exposes individuals both as a drinking source and a component of food is an important part of the picture for lead exposure through the diet, and failing to include it is rulemaking for lead in food would be a major mistake for California.